

# Decision Support System for Climate Change Adaptation and Management of Water Hazards in River Basins: *The Case of Cagayan River Basin, Philippines*

Orlando F. Balderama  
Visiting Professor

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School of Engineering, Univ. of Tokyo



REC  
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Research Center for  
Water Environment Technology  
School of Engineering, The University of Tokyo

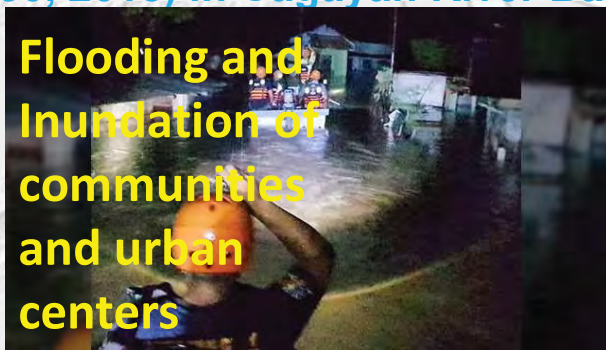


## Rationale: *Present Condition, Profile of Study Area, Approach to Basin Planning*



### Water Hazards brought by recent Typhoons (Sept. 14 and Oct. 30, 2018) in Cagayan River Basin

**Flooding and Inundation of communities and urban centers**



**Erosion, Siltation, Sedimentation**



**Debris Flow causing damage to bridges and other infrastructures**

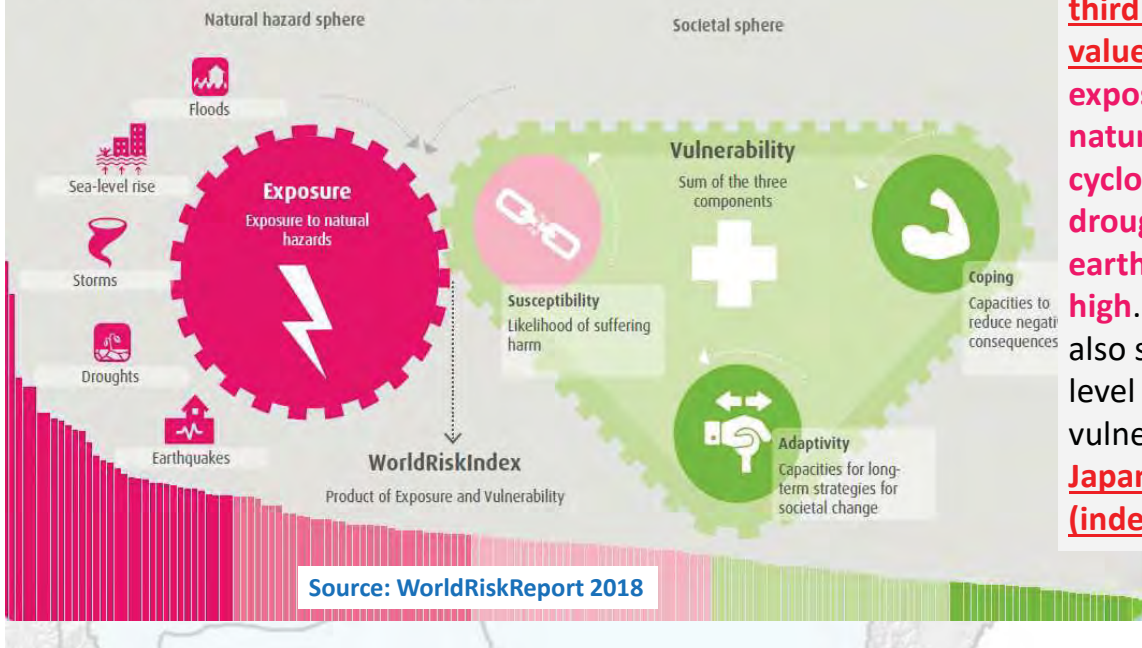


**Damage to Agriculture about 58 billion yen**



# 2018 World Risk Index Ranking

The WorldRiskIndex and its components



**The Philippines in third place (index value: 26.70).** Means exposure to extreme natural events such as cyclones, floods, drought or earthquakes is very high. Concurrently, it also show a very high level of societal vulnerability. **Japan is on rank 29 (index value: 11.08)**

# Changes in Climate in 2050

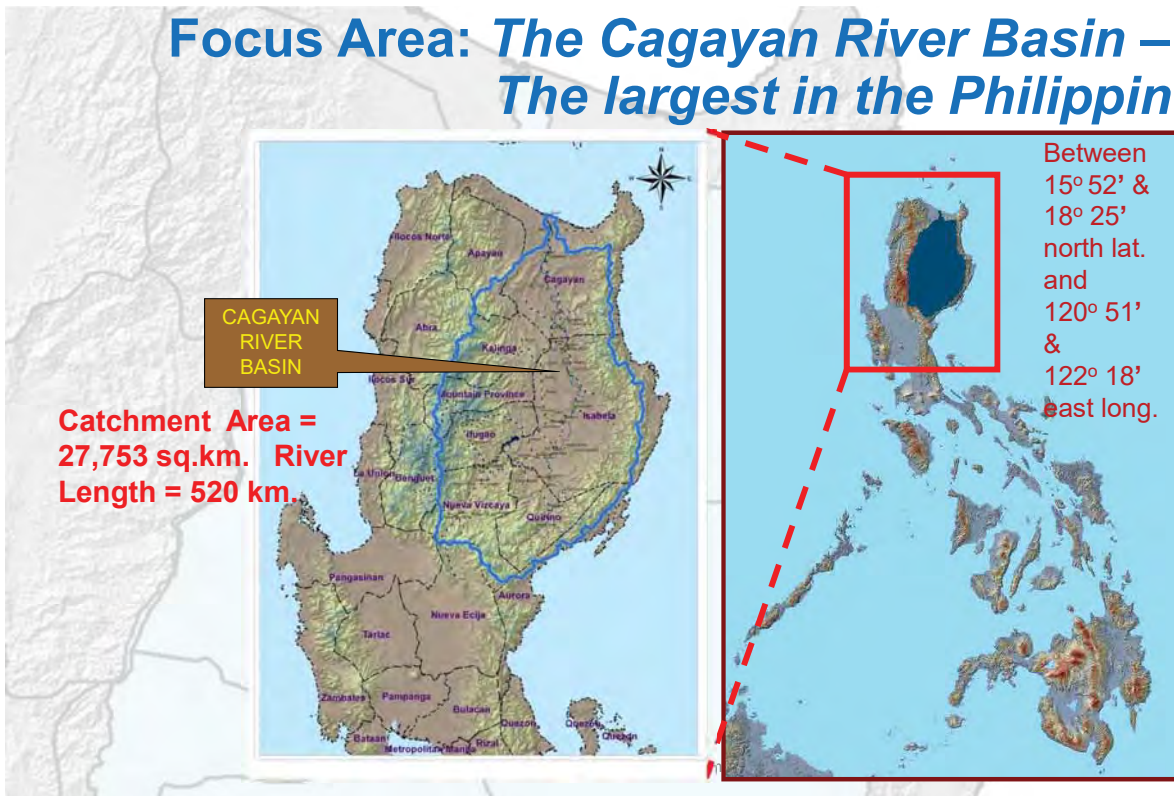
Time Frame	Temperature Increase (°C)				Rainfall Change (%)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
2036- 2065	2.0	2.1	1.6	1.9	+25.1	-29.2	8.7	1.7

Seasonal temperature increases (°C) and rainfall change (%) in 2050; **3-4 strong typhoons every year; a moderate to strong El Nino event every 2 years** in the basin



River Basin	Region	Catchment Area (km <sup>2</sup> )
<b>Cagayan</b>	<b>Region 2, CAR, Region 3</b>	<b>27,753</b>
Mindanao	Region 10, 12	23,169
Agusan	Region 13, 11	10,921
Pampanga	Region III	9,759
Agno	Region III, I	5,952
Abra	Region I and CAR	5,042
Pasig-Laguna de Bay	NCR, Region IV-A	4,678
Bicol	Region V	3,771
Abulog	Region II	3,372
Tagum-Libuganon	Region XI	3,064
Ilog-Hilabangan	Region VI and VII	1,945
Panay	Region VI	1,843
Tagoloan	Region X	1,704
Agus	ARMM and Region X	1,645
Davao	Region XI	1,623
Cagayan De Oro	Region X	1,521
Jalaur	Region VI	1,503
Buayan-Malungan	Region XI	1,434

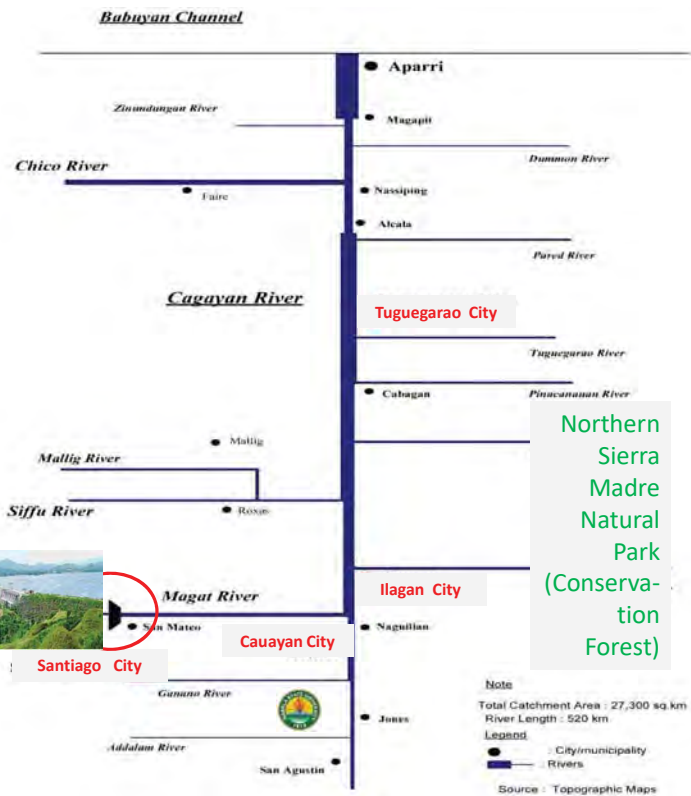
## Focus Area: *The Cagayan River Basin – The largest in the Philippines*



## Schematic River System



Cagayan River has abundant water. Average runoff at the river mouth is 1,372 m<sup>3</sup>/s or 43.2 billion m<sup>3</sup>/year. Current water consumption is very limited and water resources are sufficient in volume to supply domestic, industrial, and irrigation need. JICA (2002)



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## River Basin Condition related to water hazards – a cross cutting concern

The Philippines now has the second lowest supply of water per capita in the ASEAN region despite abundant rainfall due to poor infrastructure and management and frequent disasters (NEDA-PIDS, 2015);

The quality of water resources has been increasingly subjected to pollution from untreated sewage, industrial wastes, livestock wastes, agro-chemicals, and sediments that end up in water bodies and aquatic ecosystems, (JICA Report, 2004);

The two main causes why Cagayan Valley remains underdeveloped are: 1) inundations at the tributaries and flood; 2) water inadequacies in irrigation and domestic water supply (Basin Master Plan, 2013)

Lack of collaborative participation among water related institutions and relatively low adaptive capacity to disasters (River Basin Office, 2011).

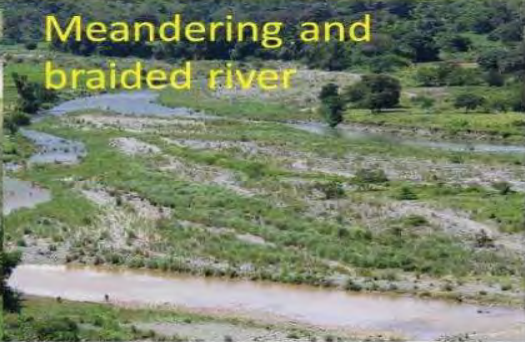
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# General Condition of River Channels

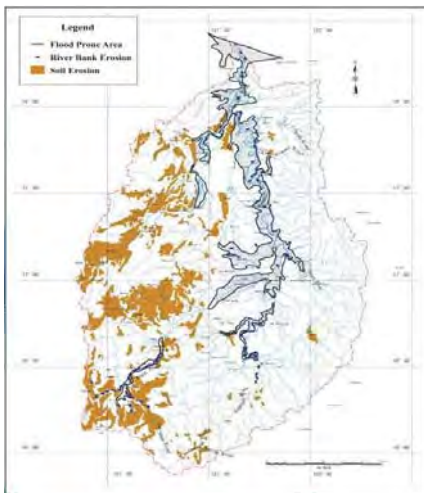
Aggrading river due to increased elevation of riverbed



Meandering and braided river



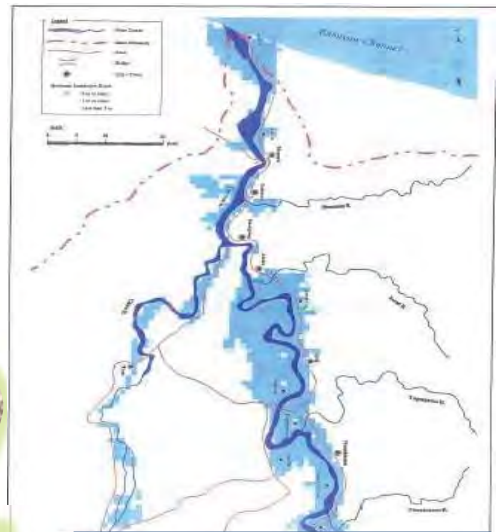
Alluvial Terraces



River Bank and Soil Erosion threatens water supply and induces more hazards

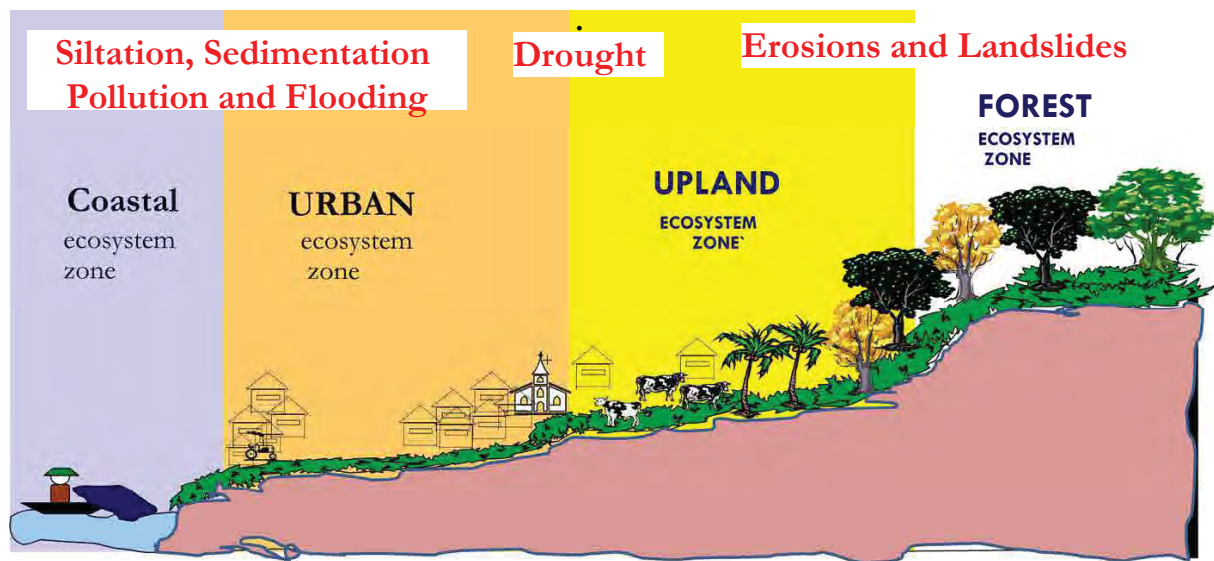


Study concludes that Cagayan Valley region is the most drought affected region with more than 1 million hectares under threat.



Recorded maximum flood that occurred in 1973, inundated an area of 1,860 km<sup>2</sup>, equivalent to 39.2% of total irrigable area in the basin.

Water Hazards such as Flood inundation, Drought and Soil Erosion are the major causes of slow economic development and environmental degradation 16



**River Basin Ecosystems and Associated Hydrometeorological/water Hazards**

## Cagayan River Basin: *Fast Facts*

- Basin Area is 2.7 million hectares, 600,000 arable land;
- Consistent top corn and rice producer in the country producing more than 25% of national production;
- Largest Groundnut and Mungbean production areas;
- Has inland lakes and reservoir of about 10,000 hectares for aquaculture production;
- Other Industrial Crops: Sugar cane, cassava with biggest bio-ethanol plant;
- Largest hydropower production
- Host to largest natural park in the country

